

APPENDIX H

A SITE-SPECIFIC RECAP EVALUATION FOR TYPICAL UST SITES AND OTHER SMALL SITES IMPACTED WITH PETROLEUM HYDROCARBON CONSTITUENTS

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H1.0 APPENDIX H UNDERGROUND STORAGE TANK (UST) AND OTHER SMALL PETROLEUM RELEASES RECAP STANDARDS

Relative to sites at large facilities (landfills, RCRA facilities, chemical plants, etc.), UST sites are unique because: (1) most sites are about the same size, (2) the constituents of concern (COC) are relatively limited, (3) the sources of COC are generally limited (i.e. tank hold, pipe chase, and dispenser islands), and (4) the exposure pathways and receptors are similar. Due to these factors and the abundance of information that has been obtained from numerous UST sites in Louisiana and across the country, site-specific RECAP Standards (RS) have been calculated for typical UST sites as an example of a MO-2 analysis that may be developed under RECAP. This analysis is consistent with the requirements for MO-2 evaluations for all sites but uses information that will be gathered during site investigation activities at UST sites. This example may be used to assist in evaluation of the numerous UST sites in Louisiana. This example may also be used to assist in the evaluation of other types of small petroleum releases (i.e., source area $1 \leq 0.5$ acre) to that meet the criteria given in Section H2.0. A more site-specific MO-2 analysis or a MO-3 analysis may be required by the Department based on site conditions.

The Appendix H provides Department-derived MO-2 RECAP Standards for the evaluation of small petroleum hydrocarbon releases to soil and groundwater that meet the criteria presented in Section H1.1. These RS represent constituent concentrations in soil and groundwater that are protective of human health and the environment. The comparison of the MO-2 Appendix H RS with the soil AOIC and/or groundwater CC serves to provide predictable, consistent guidance regarding when further evaluation and/or corrective action is warranted at a UST site. The Appendix H RS were developed for non-industrial and industrial exposure scenarios using protective assumptions with regard to the protection of human health and the prevention of cross-media transfer. The Appendix H RS comply with ARAR and consider the protection of resource aesthetics. Appendix H RS may be used to (1) document that an AOI does not pose a threat to human health or the environment and hence, does not warrant further action at this time; (2) identify areas of a facility, media, or COC that warrant further evaluation or remediation using a site-specific MO-2 or MO-3 assessment. Supplemental guidance on addressing petroleum hydrocarbons is presented in Appendix D.

H1.1 Site Categorization

UST and other small petroleum release sites evaluated using Appendix H shall be categorized into one of six categories (Category 1-Category 7) based on the site-specific fraction of organic carbon (f_{oc}) of soil representative of the vadose zone:

Fraction of Organic Carbon (f_{oc})	Category	Table
≤ 0.006	1	H-1
$> 0.006 - 0.01$	2	H-2
$> 0.01 - 0.02$	3	H-3
$> 0.02 - 0.03$	4	H-4
$> 0.03 - 0.04$	5	H-5
$> 0.04 - 0.05$	6	H-6
$> 0.05 - 0.06$	7	H-7

The f_{oc} shall be obtained during site investigation activities from an area of unimpacted soil that is representative of the characteristics of the soil within the vadose zone of the AOI. The Appendix H MO-2 RECAP Standards for soil are presented in Category Tables H-1 through H-7 at the end of this appendix.

H1.2 General Data Requirements for an Appendix H MO-2 assessment:

- (1) Horizontal and vertical boundaries of the soil and groundwater AOI;
- (2) Groundwater classification of the impacted zone based on aquifer yield and TDS or using data from a nearby site as described in Section 2.3.2;
- (3) Groundwater CC at the POC for each COC and identification of the POE;
- (5) Depth to groundwater within the impacted zone and thickness of the groundwater plume (S_d);
- (6) Distance to the nearest downgradient property boundary or the nearest downgradient location a well could be placed (if applicable);
- (7) Designated use of, and distance to, the nearest downgradient surface water body (if applicable);
- (8) Delineation of the soil source area within the vadose zone including source length of impacted soil within the vadose zone (L), source width of impacted soil within the vadose zone (S_w), and the soil AOIC;
- (9) SPLP data for COC where it is expected that the soil to groundwater pathway will be a limiting pathway (recommended).
- (10) Fraction of organic carbon (f_{oc}) present in soil representative of the vadose zone;
- (11) Exposure pathways associated with current and future land use;
- (12) Critical effects/target organs for each COC that elicits noncarcinogenic health effects (refer to Appendix D); and
- (13) Environmental fate and transport pathways for constituent migration.

H2.0 CRITERIA FOR MANAGEMENT OF A UST OR OTHER SMALL PETROLEUM RELEASE SITE (SOIL AND GROUNDWATER) UNDER APPENDIX H

In order to develop Appendix H UST RS, assumptions were made with regard to: (1) exposure potential at the AOC or the AOI (receptors, exposure pathways, exposure frequency and duration, intake rates, and cumulative exposures); and (2) site characteristics that influence constituent fate and transport (site size, soil characteristics, hydrogeological conditions, etc.). The application of risk-based and cross-media transfer standards is protective only if the AOI shares the same (or reasonably similar) characteristics as those assumed in the development of the standards. Therefore, the Appendix H RS are only applicable at UST or other small petroleum release sites that meet the criteria listed below.

An AOC or an AOI that meets the criteria presented below may be managed under Appendix H. Application of the Appendix H MO-2 RS at an AOC or an AOI that does not meet all of the criteria for management under MO-2 shall receive Department approval prior to submission of the MO-2 assessment. Appendix H management criteria include:

- (1) A non-industrial or industrial exposure scenario is applicable at the AOC.
- (2) All likely human exposure pathways associated with soil and groundwater at or adjacent to the AOC are addressed by the Appendix H MO-2 RS. The potential for vapor intrusion from shall be addressed in accordance with Section H5.0 and Appendix G.
- (3) The impacted soil and/or groundwater under investigation are in declining conditions, i.e., the constituent mass is not increasing, the source of the release has been mitigated, and the area of constituent concentrations above the MO-2 RS is not expanding. [The environmental fate and transport models used to develop the cross-media transfer RS assume steady-state concentrations over the AOI.]
- (4) NAPL is not present (i.e., If NAPL was present at the site but has been, or will be, removed to the extent practicable, the adsorbed concentrations in soil and/or the dissolved concentrations in groundwater may be addressed in the MO-2 evaluation.) [Note: The environmental fate and transport models used to develop the cross-media transfer RS assume that NAPL is not present.] MO-2 may be applied at a soil AOC/AOI where NAPL is present, if approved by the Department for the purpose of demonstrating that a CAP (refer to Section 1.2.3) is protective of human health and the environment (i.e., constituent concentrations at or reaching current or potential exposure points or cross-media transfer points are less than or equal to the MO-2 limiting RS).
- (5) The area of impacted soil is approximately 0.5 acre or less. [The Q/C parameter for the calculation of the volatilization factor for Soil_i and Soil_{ni} is based on an area of impacted soil that is 0.5 acre in size.]

Exceptions to this criterion:

- (a) Inorganic COC (the VF is not used in the development of RS for inorganic constituents); or
 - (b) The limiting MO-2 RS is based on a quantitation limit, the soil saturation concentration (Soil_{sat}), the ceiling concentration of 100,000 ppm, or an approved background concentration.
- (6) If a COC is discharging via groundwater to a surface water body, then surface water, sediment, and/or biota shall be addressed under MO-3.

The Submitter shall demonstrate to the Department that the AOI meets the above criteria to qualify for management under Appendix H and that a site investigation has been conducted in accordance with the guidelines in Appendix B. If an AOI does not meet **all** of these criteria, then LDEQ considers the AOI to be sufficiently complex to warrant a more detailed assessment of risk and the AOI shall be addressed under a more site-specific MO-2 or MO-3 depending on site-specific exposure conditions. Different AOI within a facility may be managed under different Management Options if the areas meet the criteria for management under the Options selected by the Submitter. Exposure pathways and media not addressed by the soil and groundwater MO-2 Appendix H RS shall be addressed under a site-specific MO-2 or MO-3. Refer to Appendix G for guidance on addressing the vapor intrusion pathway.

An ecological checklist shall be completed (refer to Appendix C, RECAP Form 11). If the ecological checklist indicates that an ecological assessment is warranted, then an ecological risk assessment shall be required in addition to the MO-2 human health assessment.

H3.0 APPENDIX H MO-2 RECAP STANDARDS

H3.1 Soil RECAP Standards

Soil_{ni} The Soil_{ni} represents a constituent concentration in soil that is protective of human health for non-industrial land use. The exposure pathways addressed by the Soil_{ni} include the ingestion of soil, the inhalation of volatile emissions and particulates released from soil to the ambient air, and dermal contact with soil. The Soil_{ni} is applicable to surface soil.

Soil_i The Soil_i represents a constituent concentration in soil that is protective of human health for industrial/commercial land use. The exposure pathways addressed by the Soil_i include the ingestion of soil, the inhalation of volatile emissions and particulates released from soil to the ambient air, and dermal contact with soil. The Soil_i is applicable to surface soil.

Soil_{GW} The Soil_{GW} represents a constituent concentration in soil that does not result in the leaching of an unacceptable constituent concentration from soil to groundwater. The Soil_{GW} shall be based on the classification of the groundwater to be protected: **Soil_{GW1}** shall be based on the protection of groundwater meeting the definition of Groundwater Classification 1 (the Soil_{GW1} shall not result in a groundwater concentration that exceeds the GW₁); **Soil_{GW2}** shall be based on the protection of groundwater meeting the definition of Groundwater Classification 2 (the Soil_{GW2} shall not result in a groundwater concentration that exceeds the GW₂ at the POE); **Soil_{GW3DW}** shall be based on the protection of groundwater meeting the definition of Groundwater Classification 3 that may potentially discharge to a surface water body designated as a drinking water source (the Soil_{GW3DW} shall not result in a groundwater concentration that exceeds the GW_{3DW} at the POE); and **Soil_{GW3NDW}** shall be based on the protection of groundwater meeting the definition of Groundwater Classification 3 that may potentially discharge to a surface water body designated as a non-drinking water source (the Soil_{GW3NDW} shall not result in a groundwater concentration that exceeds the GW_{3NDW} at the POE). The **Soil_{GW2}** shall be multiplied by a dilution factor (DF2) that accounts for the reduction in constituent concentration with groundwater migration from the source to the nearest downgradient property boundary or the nearest downgradient location a water well can be placed (POE). The **Soil_{GW3}** shall be multiplied by a dilution factor (DF3) that accounts for the reduction in constituent concentration with groundwater migration from the source to the nearest downgradient surface water body (POE). The dilution factor (DF) shall be obtained from Section H.3.3. **As an alternative to the Soil_{GW} RS, the soil to groundwater pathway may be evaluated using SPLP.** The soil to groundwater pathway shall be evaluated for surface soil and subsurface soil.

Soil_{sat} The Soil_{sat} concentration represents a chemical-physical limit where saturation of the soil occurs. A constituent concentration in soil at or above the Soil_{sat} indicates the potential for NAPL to be present in the soil. The Soil_{sat} parameter is only

applicable to constituents present in a liquid phase at ambient temperatures (constituents with melting points greater than 20°C). The Soil_{sat} is applicable to surface soil and subsurface soil.

The soil RECAP Standards shall be obtained from the appropriate Category Table based on the site-specific focus (Tables H-1 through H-7)

If there are multiple constituents which elicit noncarcinogenic effects on the same target organ or have the same critical effect, then the Soil_{ni} or Soil_i shall be adjusted to account for additive health effects. Refer to Section 2.5.2 and Appendix D.

The petroleum hydrocarbon concentration in soil shall not exceed: 1) a total of 6,000 mg/kg for aliphatics C₆-C₁₀ and aromatics C_{>8}-C₁₀; 2) a total of 13,000 mg/kg for aliphatics C_{>10}-C₁₆ and aromatics C_{>10}-C₁₆; and 3) a total of 30,000 mg/kg for aliphatics C_{>16}-C₃₅ (and higher) and aromatics C_{>21}-C₃₅ without Department approval (Brost and Devaul 2000; Sanders 2009). Refer to Appendix D for further guidance on addressing petroleum hydrocarbon concentration limits.

The **MO-2 Soil Limiting RECAP** Standard (LRS) shall be the lowest of: 1) Soil_{ni} or Soil_i (adjusted for additive health effects if applicable); 2) Soil_{GW} x DF (if applicable); and 3) Soil_{sat}. Refer to Section H3.3 for the DF.

H3.2 Groundwater RECAP Standards

GW₁ The GW₁ represents a constituent concentration in groundwater that is protective of human health. The exposure pathways addressed by the GW₁ include the ingestion of groundwater, dermal contact with groundwater, and the inhalation of volatile emissions associated with indoor groundwater use. The GW₁ RS is applicable to groundwater meeting the definition of Groundwater Classification 1.

GW₂ The GW₂ represents a constituent concentration that is protective of human health. The exposure pathways addressed by the risk-based GW₂ include the ingestion of groundwater, dermal contact with groundwater, and the inhalation of volatile emissions associated with indoor groundwater use. The GW₂ shall be multiplied by a dilution factor (DF₂) that accounts for the reduction in constituent concentration with groundwater migration from the source to the nearest downgradient property boundary or the nearest downgradient location a water well can be placed (POE). The dilution factor (DF₂) shall be obtained from Section H3.3. The GW₂ RS is applicable to groundwater meeting the definition of Groundwater Classification 2.

GW₃ The GW₃ represents a constituent concentration in groundwater that will not result in the cross-media transfer of a constituent from groundwater to a downgradient surface water body. The **GW₃DW** shall be based on the protection of a downgradient surface water that is classified as a drinking water

source. The GW_{3NDW} shall be based on the protection of a downgradient surface water that is classified as a non-drinking water source. The GW_{3DW} or the GW_{3NDW} shall be multiplied by a dilution factor (DF3) that accounts for the reduction in constituent concentration with groundwater migration from the source to the nearest downgradient surface water body (POE). The default dilution factor (DF3) shall be obtained from Section H3.3. A GW_3 standard shall not result in a constituent concentration in groundwater that poses unacceptable health risk for other pathways of exposure such as the inhalation of volatile emissions to an enclosed structure. The GW_3 RS is applicable to groundwater meeting the definition of Groundwater Classification 3.

Water_{sol} The $Water_{sol}$ represents a chemical-physical limit where saturation of the water occurs. Constituent concentrations in water at or above the water solubility limit indicate a potential for NAPL to be present.

The groundwater RECAP standards shall be obtained from Table H-8.

Refer to Section 2.3.2.1 for Groundwater Classification definitions and Section 2.3.2.2 for guidance on establishing the POC and POE.

If there are multiple constituents which elicit noncarcinogenic effects on the same target organ or have the same critical effect, then the GW_1 and GW_2 shall be adjusted to account for additive health effects. A GW_1 or GW_2 based on a Safe Drinking Water Act (SDWA) Maximum Contaminant Level (MCL), Treatment Technique (TT), or Taste/Odor (T/O) Advisory Level is not required to be adjusted. Refer to Section 2.5.2 for additional guidance.

The **MO-2 Groundwater Limiting RECAP Standard (LRS)** shall be the lower of: 1) GW_1 , $GW_2 \times DF2$, or $GW_3 \times DF3$; and 2) $Water_{sol}$. Refer to Section H3.3 for the DF.

H3.3 Appendix H MO-2 Dilution Factors

For $Soil_{GW2}$, $Soil_{GW3}$, GW_2 , and GW_3 , identify the Appendix H MO-2 dilution factor from the table below based on: (1) the shortest distance (X) between the source/point of compliance (POC) and the nearest downgradient point of exposure (POE); the POE for a GW_2 zone shall be the nearest downgradient property boundary or the nearest downgradient location a water well can be placed; and the POE for a GW_3 zone shall be the nearest downgradient surface water body; and (2) the source width (S_w) and the source length (L). If the distance from the source to the POE is greater than 2000 feet, then: (1) the DF for 2000 feet may be used; or (2) a site-specific dilution factor may be calculated. **Note:** If there is the potential for constituent migration to be influenced by pumping activities within the zone, then the DF values presented below are not valid and shall not be used.

Identification of the Source Width (S_w) and Length (L)

The soil source area is defined as the area of impacted soil that is serving or may serve as a source for the transfer of constituents of concern (COC) from one medium to another (e.g., soil that may release volatile emissions to air and/or leach constituents to groundwater) (refer to Section 2.3.1.4). Residual constituent concentrations in an environmental medium may serve as a source of constituent transport and/or transfer to another environmental medium. However, it should be noted that RECAP is applicable to sites that are in a declining condition (i.e., the primary source/original source of the contaminant release has been removed or mitigated and the constituent mass is not increasing). RECAP was not designed, or intended to be used to address sludges or other non-media sources. The objective of RECAP is to identify residual constituent levels in impacted media that do not pose unacceptable risk to human health or the environment.

For the identification of the Appendix H dilution factors, the soil source area is defined as the contiguous area of impacted soil within the vadose zone having COC concentrations that exceed the limiting standard applicable for the Option being implemented. The source length (L) is defined as the longest length of the soil source area parallel to groundwater flow and source width (S_w) is defined as the longest length of the soil source area perpendicular to groundwater flow (refer to Figure H-1). For LNAPL impacted sites, the soil source area should not include the impacted soil within the zone of groundwater fluctuation or smear zone present at the soil-groundwater interface (refer to Figure H-2).

X = Distance from source (POC) to POE (feet)	Appendix H MO-2 Longitudinal Dilution Factors (DF or DAF)) (dimensionless)			
	S_w & L =			
	30 ft x 30 ft	65 ft x 65 ft	100 ft x 100 ft	148 ft x 148 ft
0 - 50	2.8	1.2	1.0	1.0
51 - 100	9.1	2.5	1.5	1.1
101 - 150	20.0	4.7	2.4	1.5
151 - 250	53.0	12.0	5.5	2.9
251 - 500	212.0	46.0	20.0	9.4
501 - 750	476.0	102.0	44.0	20.0
751 - 1000	846.0	182.0	78.0	36.0
1001 - 1250	1321.0	283.0	121.0	56.0
1251 - 1500	1902.0	408.0	174.0	80.0
1501 - 1750	2588.0	555.0	237.0	108.0
1751 - 2000	3380.0	724.0	310.0	141.0

POC = point of compliance

POE = point of exposure

S_w = source width

L = source length

H3.4 Other Considerations in the Selection of the Limiting RECAP Standard

Refer to Section 2.5.3 of the main document for other factors that require consideration in the identification of the limiting RECAP MO-2 Standards.

H4.0 APPENDIX H MO-2 SOIL AND GROUNDWATER ASSESSMENT

H4.1 Soil

To determine if soil warrants further evaluation under Appendix H, the soil LRS shall be compared to the soil AOIC. If the AOIC exceeds the LRS, then the Submitter may: (1) remediate to the Appendix H MO-2 RS and comply with closure and/or post-closure requirements; or (2) conduct a site-specific MO-2 or MO-3 evaluation. If the AOIC is less than or equal to the LRS, then the COC does not require further evaluation. Refer to Section 2.3.1.3 for guidelines on determining the AOIC.

If SPLP testing is used in lieu of the Soil_{GW} to evaluate the soil to groundwater pathway, then the SPLP testing shall be conducted on the soil sample(s) exhibiting the highest constituent concentration(s). The SPLP results shall be compared to the appropriate leachate standards as follows:

Groundwater Classification 1 Leachate Standard: $GW_1 \times 20^*$

Groundwater Classification 2 Leachate Standard: $GW_2 \times 20^* \times DF2^{**}$

Groundwater Classification 3 Leachate Standard: $GW_3 \times 20^* \times DF3^{***}$

If the SPLP results are less than or equal to leachate standard, then no further evaluation of the soil to groundwater pathway is warranted. If the leachate test results are greater than leachate standard, then further evaluation of the soil to groundwater pathway is required. *The MO-2 default Summers Dilution Factor (DF_{Summers}) is 20. **Domenico longitudinal dilution factor (DF2) for a GW 2 zone; refer to Section H3.3. ***Domenico longitudinal dilution factor for a GW 3 zone; refer to Section H3.3.

4.2 Groundwater

To determine if groundwater warrants further evaluation, the groundwater LRS shall be compared to the groundwater CC. If the groundwater CC exceeds Appendix H MO-2 LRS, then the Submitter may: (1) remediate to the Appendix H MO-2 limiting RS and comply with closure and/or post-closure requirements; or (2) proceed with a site-specific MO-2 or MO-3 evaluation. If the CC is less than or equal to the LRS, then the COC does not require further evaluation. Refer to Section 2.3.2.4 for guidelines on determining the CC.

H5.0 VAPOR INTRUSION PATHWAY SCREENING AT UST AND OTHER SMALL PETROLEUM RELEASE SITES

Petroleum hydrocarbons consist of mixtures of hundreds of constituents that are volatile, semi-volatile, and nonvolatile. The petroleum hydrocarbon components that may potentially represent a vapor intrusion risk include the lighter volatile hydrocarbon constituents and fractions such as benzene, toluene, ethylbenzene, xylenes, naphthalene, 2-methylnaphthalene, aliphatics hydrocarbons $C_5 - C_{12}$, and aromatics hydrocarbons $C_{>8} - C_{21}$. Biodegradation of petroleum hydrocarbons is recognized as one of the primary removal mechanisms of petroleum hydrocarbon contaminants from the environment. Petroleum hydrocarbons can biodegrade aerobically and thereby reduce the potential for human exposure from petroleum vapor intrusion (PVI). Further, studies have shown that if at least five feet of clean (TPH-GRO ≤ 100 mg/kg), biologically active soil is present between the source of petroleum vapors and the lowest (deepest) point of the enclosed structure foundation and the soil contains sufficient oxygen (1-4% O_2) to attenuate vapors, then there is likely aerobic biodegradation occurring of the petroleum hydrocarbons. A soil vapor profile (unsaturated zone) characterized by decreasing O_2 and increasing CO_2 and CH_4 is indicative that aerobic biodegradation of petroleum hydrocarbons is occurring. The vapor inclusion zone is bounded by the horizontal and vertical separation distances which are defined as follows:

Horizontal Separation Distance is defined as the horizontal distance from the enclosed structure to a distance equal to the vertical separation distance.

Vertical Separation Distance is defined as the thickness of clean (TPH-GRO ≤ 100 mg/kg), biologically active soil between the source of petroleum hydrocarbon vapors and the lowest (deepest) point of the enclosed structure foundation. The vertical separation distance shall consider seasonal fluctuations of groundwater.

Based on the documented attenuation of petroleum hydrocarbons in the subsurface, vertical separation distances for evaluating the vapor intrusion pathway for petroleum hydrocarbon vapor sources have been recommended for defined concentrations of benzene and total petroleum hydrocarbons in soil and groundwater as follows:

H5.1 No LNAPL Present

A. Vertical Separation Distance < 6 Feet

Sites with a vertical separation distance of less than 6 feet between the source of the petroleum hydrocarbon vapors and the lowest point of the enclosed structure foundation shall be evaluated on a site-specific basis.

B. Vertical Separation Distance 6-15 Feet

a. Evaluation Criteria:

- i. Groundwater: Benzene ≤ 5 mg/L and TPH ≤ 30 mg/L

- ii. Soil: Benzene ≤ 10 mg/kg and TPH ≤ 100 mg/kg
- b. If all of the evaluation criteria are met, then PVI shall not be evaluated for the enclosed structure.
- c. If any of the evaluation criteria are not met, then soil oxygen (O₂), carbon dioxide (CO₂), and methane (CH₄) percentages shall be obtained at 1 foot intervals until groundwater is encountered or to a depth of 6 feet. If the soil oxygen percentage in all of the intervals is 1% or greater, then PVI shall not be evaluated for the enclosed structure.

C. Vertical Separation Distance >15 Feet

- a. Evaluation Criteria:
 - i. Groundwater: Benzene ≤ 5 mg/L and TPH ≤ 30 mg/L
 - ii. Soil: Benzene ≤ 10 mg/kg and TPH ≤ 250 mg/kg
- b. If all of the evaluation criteria are met, then PVI shall not be evaluated for the enclosed structure.
- c. If any of the evaluation criteria are not met, then soil oxygen (O₂), carbon dioxide (CO₂), and methane (CH₄) percentages shall be obtained at 1 foot intervals until groundwater is encountered or to depth of the source. If the soil oxygen percentage in all of the intervals is 1% or greater, then PVI shall not be evaluated for the enclosed structure.

H5.2 LNAPL Present

Identification of LNAPL: LNAPL may not readily appear in soil borings or groundwater monitoring wells and can be difficult to identify during the site investigation. Visible evidence of LNAPL observed in soil borings or groundwater monitoring wells would include measurable accumulations of free product in monitoring wells, an oily sheen on the water, and saturation of bulk soil samples.

A. Vertical Separation Distance < 15 Feet

If the vertical separation distance is ≤ 15 feet and LNAPL is present in the soil and/or on the groundwater beneath the enclosed structure (as determined by soil borings or groundwater monitoring wells placed as close to the structure as possible), then PVI shall be evaluated for the enclosed structure.

B. Vertical Separation Distance >15 Feet

- a. Evaluation Criteria: Soil: Benzene ≤ 10 mg/kg and TPH ≤ 250 mg/kg
- b. If the benzene and TPH evaluation criteria are met, then PVI shall not be evaluated for the enclosed structure.
- c. If the benzene and TPH evaluation criteria are not met, then soil oxygen (O₂), carbon dioxide (CO₂), and methane (CH₄) percentages shall be obtained at 1 foot intervals until groundwater is encountered or to depth of

the source. If the soil oxygen percentage in all of the intervals is 1% or greater, then PVI shall not be evaluated for the enclosed structure.

It is expected that these vapor inclusion zones will be appropriate for the evaluation of the vapor intrusion pathway at most petroleum release sites. However, in the event that the Department determines these recommendations are not appropriate based on site-specific conditions (e.g. presence of preferential pathways), a site-specific vapor inclusion zone shall be identified and approved by the Department.

Refer to Appendix G for further guidance on addressing the vapor intrusion pathway including identification of the vapor inclusion zone, sampling protocols, and data interpretation.

H6.0 APPENDIX H SUBMITTAL REQUIREMENTS

An Appendix H Management Option 2 Submittal Report shall be submitted to the Department for approval. This report shall, at a minimum, meet the submittal requirements listed below. Any variance from these requirements is subject to Department approval prior to submission of the Appendix H MO-2 Submittal Report. Refer to Appendix C for the RECAP Forms.

Submittal Requirements
RECAP Form 1 Submittal Summary
RECAP Form 2 Soil Analytical Data Summary
RECAP Form 3 Groundwater Analytical Data Summary
RECAP Form 4 Groundwater Monitoring Well Characteristics
RECAP Form 5 Groundwater Monitoring Well Sampling Event Summary
RECAP Form 6 Screening Option Summary for Soil (if applicable)
RECAP Form 7 Management Option Summary for Soil 0-15 ft bgs
RECAP Form 8 Management Option Summary for Soil > 15 ft bgs
RECAP Form 9 Screening Option Summary for Groundwater (if applicable)
RECAP Form 10 Management Option Summary for Groundwater
RECAP Form 11 Ecological Checklist
RECAP Form 12 NFA-ATT Documentation
RECAP Forms for the lower tiers of assessment completed for each AOI
A topographic map with AOI labeled and name of quadrangle*
A vicinity map with adjoining properties, cross streets, and land use*
A site map with all significant features*
Identification of the horizontal and vertical boundaries of the AOI for each impacted medium and a detailed AOI map with all sampling locations identified*
A description of the site including history, setting, size, geology, hydrology, and hydrogeology
Geotechnical data and soil boring logs
A description of land characteristics (such as surface water bodies) and current and future land use at and in the vicinity of the AOI including identification of receptors
The groundwater classification(s) of the zone(s) under evaluation and information used to arrive at this determination; identification of the POC, POE, and CC
A description of groundwater use at and in the vicinity (one-mile radius) of the AOI including, at a minimum, a LDNR well survey obtained within the last 12 months
Identification of all known underground utilities (≤ 15 feet bgs) within or adjacent to the AOI
Identification of the AOIC and/or CC for each COC (including all calculations and identification of the sampling locations/results used) for each AOI
Inputs, methods, and supporting calculations for submitter-derived SS and/or RS
An environmental fate and transport analysis including identification and justification of models used, a discussion on the appropriateness of the model(s) for site conditions, model outputs, boundary conditions, calibration data and sensitivity analyses, and model limitations and uncertainties
Identification of the areas/media/COC requiring further evaluation or corrective action; if recommending NFA-ATT, the basis of the recommendation
Identification of areas/media where remedial action has been conducted
Identification of landowners, lessees, and/or servitude holders

*Note: All maps must have a bar scale, legend, north arrow, contour intervals (if contoured), date data was obtained, and map date. All maps, figures, diagrams, and cross sections submitted must be legible and unless otherwise approved by the Department, not larger than 11 inches by 17 inches and must be folded to a standard report format (8.5 inches by 11 inches).